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AUTHOR(S):

OZAKI, Mayuko; MOROOKA, Toshiro; NORIMOTO, Misato; ISODA, Norio

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Development of Simplified Method of Measuring Humidity Control Index B and Its Application*[1]

Mayuko OZAKI*[2], Toshiro MOROOKA*[2],
Misato NORIMOTO*[2] and Norio ISODA*[3]

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Introduction

The B-value[1)] is known to be useful index for judging humidity control effect of wall materials used for interior of a room. This index is obtained, under the specified variation of ambient temperature, as a slope of the line by plotting logarithm of relative humidity log $H(T)$ versus temperature T measured in a closed steel box lined with a wall material. In order to measure the B-value for the wall materials in an actual room, it is necessary to obtain the same material as those used in the room. If the same materials are hard to obtain, you need to take the impractical step of cutting the material out of the wall for measurements. To avoid such difficulties, we propose a simplified way of measuring B-value in the present article. In addition, we briefly decribe its application to the large wood building called Wood Composite Hall, WCH, which was built recently on the ground of Kyoto University.

Materials and Methods

Materials used are laminated lumber, plywood, veneer, wood flooring, polypropyrene fabric and so on. As for a steel box with a base 20 cm×20 cm and a height of 25 cm in which one bottom face is open, the open face (the area of which is changeable) was covered tightly with the above material to seal the box hermetically instead of lining the closed box with materials. Specimens were then divided into two cases in which polyethylene film covered : (1) all the surfaces and edges of the sealing material except that inside the box-semi

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*[2] Laboratory of Property Enhancement.
*[3] Nara Women's University.

Table 1. Variation of B-value for luminated wood by three different methods

The ratio of open face area or lined area to the inner volume of the box (l/m)	Measuring method	B value $\times 10^4$, $°C^{-1}$
2.895 (whole bottom face)	Conventional (3)	7
	Semi conventional (1)	1
	Simplified (2)	−1
0.965 (one-third of the bottom face)	Conventional (3)	−32
	Semi conventional (1)	−32
	Simplified (2)	−40
0.482 (one-sixth of the bottom face)	Conventional (3)	−94
	Semi conventional (1)	−69
	Simplified (2)	−62

conventional method, or (2) only their edges-simplified method. We further prepared specimens (3) according to the conventional method described above. Using these three types of specimens, we measured B-value by varying temperature and humidity sinosoidally in an automatically controlled chamber (condition (a)) or under natural variation of temperature and humidity in a room with a wide-open window (condition (b)). Both measurements were made for at least one week.

Results and Discussion

The B-values for laminated wood obtained from the specimens (1), (2) and (3) under the condition (a) are compared in Table 1. They are much the same irrespective of the fraction of exposed area of materials inside the box. The similar results were also recognized for many other materials examined. For materials with high moisture permeability, however, the B-value measured from (2) i.e. simplified method was different from those obtained from (1) or (3). In such cases, it was seen that materials with the same moisture permeability gave the same B-value regardless of the kinds of materials or their thickness.

On the other hand, the plots of $\log H(T)$ vs. T measured under the condition (b) vary widely because of the fluctuation in outdoor temperature, and thus the determination of B-values became inaccurate under this condition. Because each set of plots measured in a day gave similar slope with each other, we could determine B-value as their average by separating plots for one day only from whole plots. As for materials examined, the B-values thus obtained corresponded well with the above results measured under the condition (a). From these findings, it was found that the simplified method, i.e., method (2), could be used for measuring B-value without any control of ambient temperature instead of using the conventional method in a controlled chamber.

In applying the simplified mathod for measuring B-value described above, we

investigated humidity environment of the top floor room w3 of WCH. The w3 room exhibits little variation of humidity though the flooring and other interior material lined in w3 room exhibits B-value as low as −200 which indicates low humidity control effect[2]. To explain this contradiction between low humidity control properties of materials and digh stability of humidity in the w3 room, we made a survey of humidity control effect of materials which were in the constructed state in the surrounding building structure of the w3 room by using a simplified method. Among the space surrounding the w3 room, the plenum above suspended ceiling situated just above the w3 room showed a violent humidity variation. The cause of this phenomenon was ascribed to the roof board made of cement bonded particle board, which shows remarkable absorption and desorption properties due to solar radiation rather than temperature change in the plenum area. It was found that the migration of humidity from this area to the w3 room governs humidity environment for the w3 room, resulting in unchanged humidity in the w3 room.

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